## REMARKS

Claims 1-4, 6-12, and 14-40 are pending in this application. By this Amendment, claims 1, 3-4, 6-7, 9, 11-12, 14-15, 17, 21-22, 27, 32, 37-40 are amended and claims 5 and 13 are canceled without prejudice or disclaimer of the subject matter contained therein.

The courtesies extended to Applicant's representative by Examiner Siangchin and Supervisory Patent Examiner Au at the interview held September 1, 2004, are appreciated. The reasons presented at the interview as warranting favorable action are incorporated into the remarks below and constitute Applicant's record of the interview.

### I. Information Disclosure Statement (IDS)

References submitted with an IDS filed on September 13, 2001, have not been acknowledged by the Examiner. Accordingly, acknowledgment of the IDS by initializing the submitted PTO-1449 Form and forwarding a copy of the initialized PTO-1449 Form in the next Patent Office communication is respectfully requested.

### II. Objection to the Drawings

The Office Action objects to the drawings based on formal matters. Applicant respectfully submits that the Formal Drawings submitted with a Letter to the Official Draftsperson on September 14, 2001 obviate the objection based on formal matters. Further, the Office Action asserts that Fig. 10 does not correlate to the discussion found in the last paragraph of page 23 of the disclosure. Applicant respectfully submit the Fig. 10 represents a slit pattern of the board 606, which has been newly coded. It is respectfully submitted that the above-mentioned paragraph is clear on this matter. Accordingly, withdrawal of the objection to the drawings is respectfully requested.

## III. Objection to the Specification

1. Objection to the Title

The Office Action objects to the title. The title has been amended to obviate the objection.

2. Objection to the Disclosure

The Office Action objects to the written description based on formal matters. The written description has been amended to obviate the objection.

Regarding item d., as mentioned above, the slit pattern of the board 606 is re-coded as in Fig. 10 to distinguish over the slit pattern of the wall 605. It is respectfully submitted that this is clear in the discussion found in the last paragraph of page 23 of the disclosure.

3. Objection to the Summary of the Invention

The Office Action objects to the Summary of the Invention. The Summary of the Invention has been amended to obviate the objection.

## IV. The Claims Satisfy Formal Matters

The Office Action objects to claims 6 and 14 based on formal matters. The claims have been amended to obviate the objection.

## V. Rejection Based on 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 7, 15, 17, 22, 27, 32 and 37-40 under 35 U.S.C. §112, second paragraph, as being infinite. The above-mentioned claims have been amended to overcome the rejection.

## VI. The Claims Define Patentable Subject Matter

The Office Action rejects claims 1, 8, 9 and 16 under 35 U.S.C. §102(b) over Kang ("A Multibaseline Stereo System with Active Illumination and Real-Time Image Acquisition"); rejects claims 2-4, 7, 10-12 and 15 under 35 U.S.C. §103(a) over Kang in view of Batlle ("Recent Progress in Coded Structured Light as a Technique to Solve the

Correspondence Problem: A Survey", Pattern Recognition, 1998); rejects claims 6 and 14 under 35 U.S.C. §103(a) over Kang in view of Mack (U.S. Patent No. 6,377,700); rejects claims 5 and 13 under 35 U.S.C. §103(a) over Kang in view of Perona (U.S. Patent No. 6, 044, 165); rejects claims 27-30 under 35 U.S.C. §103(a) over Saund (U.S. Patent No. 5,764,383) in view of Perona; rejects claims 17-24, 26-27, 31-34 and 36-40 under 35 U.S.C. §103(a) over Saund in view of Stolfo (U.S. Patent No. 5,668,897); and rejects claims 25 and 35 under 35 U.S.C. §103(a) over Saund in view of Stolfo, and further in view of Wellner (U.S. Patent No. 5,511,148). Applicant respectfully traverses the rejection.

In particular, none of the applied references disclose or suggest an image processing part that retrieves only differential data between successive frame data in the time-series as storage data based on a result of the comparison of the frame data comparison part of the initial frame data and frame data subsequently transformed in the time-series, as recited in independent claim 1; retrieving only differential data between successive geometric-transformed intensity images in the time series as storage data based on a result of the comparison of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series; as recited in independent claim 9; an image processing part that retrieves only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison of the image extracting part of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series, as recited in independent claims 17 and 38; and retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of

the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series, as recited in independent claims 27, 37, 39 and 40.

Kang discloses in the abstract a parallel depth recovery scheme which uses a light pattern with frequency modulated sinusoidally of varying intensity onto a target.

Batlle discloses in the abstract coded structured light methods that are employed to get 3D information.

Mack discloses at col. 5, lines 49-51, using a non-visible light source to create structured light.

Perona discloses at col. 2, line 66 - col. 3, line 8, a system for tracking, for example, a pen tip movement relative to a writing surface, by first determining an initial position of a pen tip. Then the image neighborhood around the initial position of the pen tip is assembled into a "kernel." This kernel is used to determine the position of the pen in subsequent frames. Importantly, Perona discloses at col. 3, lines 43-45 that Perona's system preferably monitors relative movement of the writing implement, instead of imaging previously-written characters.

Saund discloses at col. 5, lines 48-53, a method of using structured light to detect a three-dimensional object of a page, and thereby correct distortions caused by image perspective, skew, and compression caused by compression or elongation introduced by uneven surface of a bound document.

Stolfo discloses at col. 11, lines 18-28, a system that stores a set of codebook of data images of financial instruments or standardized documents; scanning an instrument;

comparing the scanned image against the codebook; subtracting the codebook image from the scanned image; and compressing the leftover handwritten or post-printed information.

Wellner discloses in Figs. 1-3 and on page 88, a DigitalDesk where a computer display is projected onto a desk, and video cameras pointed down at the desk feed an image-processing system that senses what a user is doing.

However, none of the above references disclose or suggest an image processing part that retrieves only differential data between successive frame data in the time-series as storage data based on a result of the comparison of the frame data comparison part of the initial frame data and frame data subsequently transformed in the time-series, as recited in independent claim 1; retrieving only differential data between successive geometric-transformed intensity images in the time series as storage data based on a result of the comparison of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series; as recited in independent claim 9; an image processing part that retrieves only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison of the image extracting part of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series, as recited in independent claims 17 and 38; and retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data

between successive geometric-transformed intensity images in the time-series, as recited in independent claims 27, 37, 39 and 40.

Therefore, independent claims 1, 9, 17, 27 and 37-40 define patentable subject matter. Claims 2-4, 6-8, 10-12, and 14-16, 18-26 and 28-36 depend on the respective independent claims, and therefore also define patentable subject matter, as well as for the other features they recite. Accordingly, withdraw of the rejections under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) are respectfully requested.

## VII. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-4, 6-12, and 14-40 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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Date: September 7, 2004

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**Amendments to the Specification**

Please replace the title as follows:

IMAGE PROCESSING APPARATUS, IMAGE PROCESSING METHOD, AND STORAGE MEDIUM FOR PICKED UP IMAGES

Please cancel paragraphs at page 3, line 12 through page 13, line 26.

Please add the following new paragraph after the subtitle "SUMMARY OF THE INVENTION" on page 3, line 11:

According to an aspect of the present invention, an image processing apparatus efficiently identifies, for example, input characters and the like by an intensity image analysis based on range information. The image processing apparatus performs distance measurement by performing three-dimensional measurement by pattern projection, for example, to written characters and gets an intensity image as a so-called actual image and an image for distance measurement in parallel, and identifies, for example, input characters by an intensity image analysis based on range information.

The image processing apparatus, for example, picks up characters, patterns, and the like written on paper or like with a pen, performs geometric transformation for picked up images, and performs natural input character analysis and read processing. Furthermore, by comparing images picked up in a time-series, noise elimination and manuscript position modifications become possible.

These and other characteristics and advantages of the present invention will become apparent by more detailed descriptions based on embodiments of the present invention to be described and accompanying drawings.

Please add the following new paragraphs after the subtitle "DESCRIPTION OF THE PREFERRED EMBODIMENTS" on page 17, line 7:

The present invention has been made in view of the above circumstances and provides an image processing apparatus and an image processing method that perform distance measurement with a simple construction, gets an intensity image used as a so-called actual image and an image for distance measurement in parallel, and identifies input characters by an intensity image analysis based on range information.

According to an aspect of the present invention, the image processing apparatus has: a three-dimensional image pickup part that includes a projecting part that projects patterns, a first image pickup part that picks up an intensity image and a projection pattern image from the direction of an optical axis of the projecting part, and a second image pickup part that picks up the projection pattern image from a direction different from the optical axis of the projecting part. First range information is created based on a pattern picked up by the second image pickup part and a geometric transformation part that performs geometric transformation for the intensity image picked up by the first image pickup part based on the range information.

Furthermore, in the image processing apparatus of the present invention, for areas where the amount of change of the picked-up pattern by the first image pickup part with respect to the projection pattern is equal to or greater than a predetermined value, new codes corresponding to the picked-up pattern by the first image pickup part may be assigned, and the first range information may be created from the picked-up pattern by the second image pickup part, based on the new codes.

Furthermore, the image processing apparatus may further have: a frame data comparison part that makes comparisons between frame data images picked up in a time-series by the three-dimensional image pickup part; and an image processing part that eliminates noise data from the frame data images based on a result of making comparisons between the frame data images in the frame data comparison part.

Furthermore, the image processing apparatus may further have: a frame data comparison part that makes comparisons between frame data images picked up in a time-series by the three-dimensional image pickup part; and an image processing part that modifies image positions of the frame data images based on a result of making comparisons between the frame data images in the frame data comparison part.

Furthermore, the image processing apparatus may further have: a storage part that stores, as initial frame data, an initial image of frame data picked up in a time-series by the three-dimensional image pickup part; a frame data comparison part that makes comparisons between frame data images picked up in a time-series by the three-dimensional image pickup part; and an image processing part that extracts only differential data as storage data, based on a result of comparing, in the frame data comparison part, the initial frame data with frame data subsequently picked up.

Furthermore, in the image processing apparatus of the present invention, the projecting part may have a light source to emit light of an invisible region; and the first and second image pickup parts may have a filter for transmitting light of an invisible region and a filter for cutting off light of an invisible region, and may pick up pattern projection images and intensity images in parallel.

Furthermore, in the image processing apparatus of the present invention, for areas where the amount of change of the picked-up pattern by the first image pickup part with respect to the projection pattern by the projecting part is less than a predetermined value, second range information may be created by bringing the areas into correspondences with respective pieces of intensity information obtained by the first and second image pickup parts.

Furthermore, in the image processing apparatus of the present invention, the second image pickup part may include plural image pickup parts that pick up the measurement target

at different angles, and range information may be created based on projection patterns respectively picked up by the plural image pickup parts.

Furthermore, according to another aspect of the present invention, the image processing method includes: a projecting step that projects patterns by a projecting part; an image pickup step that picks up an intensity image and a projection pattern image by a first image pickup part from an optical axis direction of the projecting part, and picks up the projection pattern image by a second image pickup part from a direction different from the optical axis direction of the projecting part; a range information creation step that creates first range information, based on a picked-up pattern picked up by the second image pickup part; and a geometric transformation step that performs geometric transformation for the intensity image produced by the first image pickup part, based on the range information.

Furthermore, in the image processing method of the present invention, the range information creation step may include the step of: for areas where the amount of change of the picked-up pattern by the first image pickup part with respect to the projection pattern is equal to or greater than a predetermined value, assigning new codes corresponding to the picked-up pattern by the first image pickup part, and creating the first range information from the picked-up pattern by the second image pickup part, based on the new codes.

Furthermore, the image processing method may further include: a frame data comparison step that makes comparisons between frame data images picked up in a time-series in the image pickup step; and an image processing step that eliminates noise data from the frame data images, based on a result of making comparisons between the frame data images in the frame data comparison step.

Furthermore, the image processing method may further include: the frame data comparison step that makes comparisons between frame data images picked up in a time-series in the image pickup step; and an image processing step that modifies image positions of

the frame data images, based on a result of making comparisons between the frame data images in the frame data comparison step.

Furthermore, the image processing method may further include: a storage step that stores an initial image of frame data picked up in a time-series in the image pickup step in a storage part as initial frame data; a frame data comparison step that makes comparisons between frame data images picked up in a time-series in the image pickup step; and an image processing step that extracts only differential data as storage data, based on a result of comparing, in the frame data comparison step, the initial frame data and frame data got subsequently.

Furthermore, in the image processing method of the present invention, the pattern projecting step may use the light source as an invisible-region light source using infrared or ultraviolet light, and may form pattern light by invisible-region light; and the image pickup step may pick up pattern projection images and intensity images in parallel.

Furthermore, in the image processing method of the present invention, for areas where the amount of change of the picked-up pattern by the first image pickup part with respect to the projection pattern by the projecting part is less than a predetermined value, second range information may be created by bringing the areas into correspondences with respective pieces of intensity information obtained by the first and second image pickup parts.

Furthermore, in the image processing method of the present invention, the second image pickup part may include plural image pickup parts that pick up the measurement target at different angles, and the method may include the step of creating range information, based on projection patterns respectively picked up by the plural mage pickup parts.

According to another aspect of the present invention, the image processing apparatus includes: a projecting part that projects light to an image holding medium to form an image thereon; an image pickup part that picks up the image formed on the image holding medium;

an intensity image acquisition part that acquires an intensity image, based on the image picked up in the image pickup part; a range information acquisition part that acquires range information from the picked-up image; a geometric transformation part that performs geometric transformation for the intensity image, based on the range information acquired in the range information acquisition part; and an image extracting part that extracts differences between the geometric-transformed intensity image and the intensity image acquired in advance.

Furthermore, in the image processing apparatus of the present invention, the image holding medium is one of a manuscript sheet, whiteboard, blackboard, screen, wall, and screen projection sheet.

Furthermore, in the image processing apparatus of the present invention, the intensity image acquired in advance as a processing target in the image extracting part may be a preceding frame image inputted precedent to the geometric transformation part.

Furthermore, in the image processing apparatus of the present invention, the intensity image acquired in advance as a processing target in the image extracting part may be image data stored in advance in the storage part.

Furthermore, the image processing apparatus may include: a document database in which plural pieces of document format data are stored; and a document identifying part that performs matching between the geometric-transformed intensity image and format images stored in the document database. The image extracting part may extract differences between the geometric-transformed intensity image and format images stored in the document database.

Furthermore, the image processing apparatus may further have a character transformation processing construction that reads character data extracted by the image extracting part and transforms it to character data replaceable as code values.

Furthermore, the image processing apparatus may further include: an authentication information database in which handwriting history data of registered users is stored; and an authentication processing part that inputs the geometric-transformed intensity image and performs matching between the input image and handwriting history data stored in the authentication information database.

Furthermore, in the image processing apparatus of the present invention, the authentication information database may store handwriting history data and signature shape data of registered users; and the authentication processing part may input the geometric-transformed intensity image, and performs matching between the input image and the handwriting history data stored in the authentication information database, and between the input image and the signature shape data.

Furthermore, the image processing apparatus may further include a display part that displays an image produced as a result of performing geometric transformation for the intensity image, based on the range information in the geometric transformation part.

Furthermore, in the image processing apparatus of the present invention, a distance between an image holding medium and the image pickup part may be fixed; the image processing apparatus may include a storage part that stores range information acquired by the range information acquisition part; and the geometric transformation part performs geometric transformation for the intensity image, based on the range information stored in the storage part.

Furthermore, according to another aspect of the present invention, the image processing method includes: a projecting step that projects light to an image holding medium to form an image thereon; an image pickup step that picks up the image formed on the image holding medium; an intensity image acquisition step that acquires an intensity image, based on the image picked up in the image pickup step; a range information acquisition step that

acquires range information from the picked-up image; a geometric transformation step that performs geometric transformation for the intensity image, based on the range information acquired in the range information acquisition step; and an image extracting step that extracts differences between the geometric-transformed intensity image and the intensity image acquired in advance.

Furthermore, in the image processing method of the present invention, the image holding medium is one of a manuscript sheet, whiteboard, blackboard, screen, wall, and screen projection sheet.

Furthermore, in the image processing method of the present invention, the intensity image acquired in advance as a processing target in the image extracting step may be a preceding frame image inputted precedent to the geometric transformation step.

Furthermore, in the image processing method of the present invention, the intensity image acquired in advance as a processing target in the image extracting step may be image data stored in advance in the storage part.

Furthermore, the method may further include: a document identifying step that performs matching between the geometric-transformed intensity image and format images stored in the document database in which plural pieces of document format data are stored. The image extracting step may extract differences between the geometric-transformed intensity image and format images stored in the document database.

Furthermore, the method may further have a character transformation processing step that reads character data extracted in the image extracting step and transforms it to character data replaceable as code values.

Furthermore, the method may include: an authentication processing step that inputs the geometric-transformed intensity image and performs matching between the input image

and handwriting history data stored in the authentication information database in which handwriting history data of registered users is stored.

Furthermore, in the image processing apparatus of the present invention, the authentication information database may store handwriting history data and signature shape data of registered users; and the authentication processing step may input the geometric-transformed intensity image, and performs matching between the input image and the handwriting history data stored in the authentication information database, and between the input image and the signature shape data.

Furthermore, the method may further include a display step that displays an image produced as a result of performing geometric transformation for the intensity image, based on the range information in the geometric transformation step.

Furthermore, in the image processing method of the present invention, a distance between an image holding medium and the image pickup part may be fixed; the image processing method may include a storage step that stores range information acquired by the range information acquisition part; and the geometric transformation step performs geometric transformation for the intensity image, based on the range information stored in the storage step.

Furthermore, according to another aspect of the present invention, a storage medium readable by a computer, which stores a program of instructions executable by the computer to perform method steps for performing image processing is provided. The method includes the steps of: projecting light to an image holding medium to form an image thereon; picking up the image formed on the image holding medium; acquiring an intensity image based on the image picked up in the image pickup step; acquiring range information from the picked-up image; performing geometric transformation for the intensity image based on the range information acquired in the range information acquisition step; and extracting difference

between the geometric-transformed intensity image and the intensity image acquired in advance.

Furthermore, according to another aspect of the present invention, an image processing apparatus includes: a projecting part that projects light; an image pickup part that picks up the projected light; an intensity image acquisition part that acquires an intensity image from the picked-up light; a range information acquisition part that acquires range information from the picked-up light; a geometric transformation part that performs geometric transformation for the intensity image, based on the range information; and an image extracting part that extracts differences between the intensity image subjected to the geometric transformation and an intensity image acquired in advance.

Furthermore, according to another aspect of the present invention, an image processing method includes: a projecting step that projects light; an image pickup step that picks up the projected light; an intensity image acquisition step that acquires an intensity image from the picked-up light; a range information acquisition step that acquires range information from the picked-up light; a geometric transformation step that performs geometric transformation for the intensity image, based on the range information; and an image extracting step that extracts differences between the intensity image subjected to the geometric transformation and an intensity image acquired in advance.

Furthermore, according to another aspect of the present invention, a storage medium readable by a computer, which stores a program of instructions executable by the computer to perform method steps for performing image processing is provided. The method includes the steps of: a projecting step that projects light; an image pickup step that picks up the projected light; an intensity image acquisition step that acquires an intensity image from the picked-up light; a range information acquisition step that acquires range information from the picked-up light; a geometric transformation step that performs geometric transformation for the intensity

image, based on the range information; and an image extracting step that extracts differences between the intensity image subjected to the geometric transformation and an intensity image acquired in advance.

By providing a program in a computer-readable format, processing is performed on a compute system according to the program. By installing the computer program in the computer system, cooperative operations are delivered on the computer system and the same effect as other aspects of the present invention can be obtained.

Please replace the paragraph beginning on page 21, line 22, with the following rewritten paragraph:

As the light sources 106 shown in FIG. 2, light sources (whether visible region or invisible region) of wavelength band in which image pickup is possible may be used. In this case, as the camera 3 (shown as 103 in the figure), a CCD camera of progressive scan type is used, and the camera 1 (shown as 101 in the figure) and the camera 2 (shown as 102 in the figure) are not limited to a specific configuration. However, it is desirable to use a CCD camera of the same configuration in terms of match with the camera 3 (103). Patterns are projected from the light sources 106 and the three cameras 1 to 3 (101 to 103) perform image pickup at the same time. The cameras obtain light passing through the filters ~~304~~302 and ~~305~~304 (see FIG. 3) by the image pickup apparatuses 303 and 305, thereby obtaining images at a time.

Please replace the paragraph beginning on page 22, line 21, with the following rewritten paragraph:

FIG. 4 is a flowchart for re-coding. Each slit pattern is longitudinally split for each slit width (step ~~1001~~S11) to create square cells. An average value of strength is taken for each of the created cells, and the average value is defined as the strength of the cell (step ~~1002~~S12). Sequentially from the center of an image, the strengths of corresponding cells

between a projection pattern and a pick-up pattern are compared, and it is judged whether a difference between the strengths of the cells is equal to or greater than a threshold value because the patterns change due to factors such as the reflectivity of an object and a distance from the object (step ~~1003~~S13). Unless the difference is equal to or greater than a threshold value, re-coding for all picked-up cells terminates (step ~~1007~~S17).

Please replace the paragraph beginning on page 23, line 5, with the following rewritten paragraph:

If the difference is equal to or greater than a threshold value, it is judged whether the cell is a cell of new strength (step ~~1004~~S14). When the cell is a cell of new strength, a new code is created and allocated (step ~~1005~~S15). When the cell is not a cell of new strength, a code is created using the placement of slit patterns identifiable with parts of other occurrences (step ~~1006~~S16). This terminates re-coding (step ~~1007~~S17).

Please replace the paragraph beginning on page 41, line 16, with the following rewritten paragraph:

By forming the document identifying part 2001 and the document database 2002 described in the second embodiment within the personal computer (PC) 2803, data written by a user onto a document format projected on the whiteboard 2801 using, e.g., an OHP ~~2805~~2804 can be subjected to the same processing as described in the second embodiment example.

**Amendments to the Claims**:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) An image processing apparatus, comprising:

a three-dimensional image pickup part that includes a projecting part that projects a pattern, a first image pickup part that picks up an intensity image and a projection pattern image from the direction of an optical axis of the projecting part, and a second image pickup part that picks up the projection pattern image from a direction different from the optical axis of the projecting part, the three-dimensional image pickup part creating first range information based on a pattern picked up by the second image pickup part; ~~and~~

a geometric transformation part that performs geometric transformation for the intensity image picked up by the first image pickup part, based on the first range ~~information.~~information;

a storage part that stores, as initial frame data, an initial image of frame data in a time-series transformed by the geometric transformation part;

a frame data comparison part that makes comparison between successive frame data images in the time-series transformed by the geometric transformation part; and

an image processing part that retrieves only differential data between successive frame data in the time-series as storage data based on a result of the comparison of the frame data comparison part of the initial frame data and frame data subsequently transformed in the time-series.

2. (Original) The image processing apparatus according to claim 1, wherein, for an area where the amount of change of the pattern picked up by the first image pickup part with respect to the projection pattern is equal to or greater than a predetermined value, new code corresponding to the pattern picked up by the first image pickup part is assigned, and the first

range information is created from the pattern picked up by the second image pickup part based on the new code.

3. (Currently Amended) The image processing apparatus according to claim 1, ~~further comprising:~~wherein

~~a frame data comparison part that makes comparison between frame data images picked up in a time-series by the three-dimensional image pickup part; and~~

~~an~~the image processing part ~~that~~ eliminates noise data from the frame data image based on a result of the comparison between the frame data images in the frame data comparison part.

4. (Currently Amended) The image processing apparatus according to claim 1, ~~further comprising:~~wherein

~~a frame data comparison part that makes comparison between frame data images picked up in a time-series by the three-dimensional image pickup part; and~~

~~an~~the image processing part ~~that~~ modifies a position of the frame data image based on a result of the comparison between the frame data images in the frame data comparison part.

5. (Canceled).

6. (Currently Amended) The image processing apparatus according to claim 1, wherein:

the projecting part has a light source to emit light of an invisible region of a wavelength band; and

the first and second image pickup parts have a filter for transmitting light of the invisible region of the wavelength band and a filter for cutting off light of ~~an~~ the invisible region of the wavelength band, and pick up the projection pattern image and intensity image in parallel.

7. (Currently Amended) The image processing apparatus according to claim 1, wherein, for an area where the amount of change of the pattern picked up by the first image pickup part with respect to the projection pattern by the projecting part is less than a predetermined value, second range information is created by ~~bringing the area into~~deriving a correspondence ~~with~~between intensity information obtained by the first and second image pickup parts.

8. (Original) The image processing apparatus according to claim 1, wherein the second image pickup part includes plural image pickup parts that pick up the measurement target at different angles, and range information is created based on projection patterns respectively picked up by the plural image pickup parts of the second image pickup part.

9. (Currently Amended) An image processing method, comprising:

projecting a pattern by a projecting part;

picking up an intensity image and a projection pattern image by a first image pickup part from an optical axis direction of the projecting part, and picking up the projection pattern image by a second image pickup part from a direction different from the optical axis direction of the projecting part;

creating first range information based on the pattern picked up by the second image pickup part; ~~and~~

performing geometric transformation for the intensity image produced by the first image pickup part based on the range ~~information.~~information;

storing an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step;

making comparison between successive geometric-transformed intensity images in the time-series transformed in geometric transformation step; and

retrieving only differential data between successive geometric-transformed intensity images in the time series as storage data based on a result of the comparison of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series.

10. (Original) The image processing method according to claim 9, wherein the range information creation step includes the step of:

for an area where the amount of change of the pattern picked up by the first image pickup part with respect to the projection pattern is equal to or greater than a predetermined value, assigning new code corresponding to the pattern picked up by the first image pickup part, and creating the first range information from the pattern picked up by the second image pickup part based on the new code.

11. (Currently Amended) The image processing method according to claim 9, further comprising:

~~making comparison between frame data images picked up in a time-series in the image pickup step; and~~

eliminating noise data from the frame data image based on a result of the comparison between the frame data images in the frame data comparison step.

12. (Currently Amended) The image processing method according to claim 9, further comprising:

~~making comparison between frame data images picked up in a time-series in the image pickup step; and~~

modifying a position of the frame data image based on a result of the comparison between the frame data images in the frame data comparison step.

13. (Canceled)

14. (Currently Amended) The image processing method according to claim 9, wherein:

a pattern light is formed by a ~~invisible-region~~ light of an invisible-region of a wavelength band by using ~~an invisible-region light source using~~ infrared or ultraviolet light as the light source; and

the pattern projection image and intensity image are picked up in parallel.

15. (Currently Amended) The image processing method according to claim 9, further comprising the step of:

for an area where the amount of change of the pattern picked up by the first image pickup part with respect to the projection pattern by the projecting part is less than a predetermined value, creating second range information by ~~bringing the area into~~deriving a correspondence ~~with~~between intensity information obtained by the first and second image pickup parts.

16. (Original) The image processing method according to claim 9, wherein:

the second image pickup part includes plural image pickup parts that pick up the measurement target at different angles, and includes the step of creating range information based on projection patterns respectively picked up by the plural image pickup parts of the second image pickup part.

17. (Currently Amended) An image processing apparatus, comprising:

a projecting part that projects light to an image holding medium to form an image thereon;

an image pickup part that picks up the image on the image holding medium projected by the projecting part;

an intensity image acquisition part that acquires an intensity image based on the image picked up by the image pickup part;

a range information acquisition part that acquires range information from the picked-up image;

a geometric transformation part that performs geometric transformation for the intensity image based on the range information acquired in the range information acquisition part; ~~and~~

an image extracting part that extracts difference between a geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

a storage part that stores, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed by the geometric transformation part;

the image extracting part making comparison between successive geometric-transformed intensity images in the time-series transformed by the geometric transformation part; and

an image processing part that retrieves only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison of the image extracting part of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.

18. (Original) The image processing apparatus according to claim 17, wherein the image holding medium is one of a manuscript sheet, whiteboard, blackboard, screen, wall, and screen projection sheet.

19. (Original) The image processing apparatus according to claim 17, wherein the intensity image acquired in advance as a processing target in the image extracting part is a preceding frame image inputted precedent to the geometric transformation part.

20. (Original) The image processing apparatus according to claim 17, further comprising:

a storage part that stores image data,

wherein the intensity image acquired in advance as a processing target in the image extracting part is the image data stored in advance in the storage part.

21. (Currently Amended) The image processing apparatus according to claim 17, further comprising:

a document database in which plural pieces of document format data are stored; and

a document identifying part that performs matching between the geometric-transformed intensity image and the pieces of document format data stored in the document database,

wherein the image extracting part extracts differences between the geometric-transformed intensity image and the pieces of document format data stored in the document database.

22. (Currently Amended) The image processing apparatus according to claim 17, further comprising a character transformation processing part that reads character data extracted by the image extracting part and ~~transforms it to character data replaceable as a code value~~identifies the character data with identification data.

23. (Original) The image processing apparatus according to claim 17, further comprising:

an authentication information database in which handwriting history data of registered users is stored; and

an authentication processing part that inputs the geometric-transformed intensity image and performs matching between the input image and handwriting history data stored in the authentication information database.

24. (Original) The image processing apparatus according to claim 23, wherein:

the authentication information database stores handwriting history data and signature shape data of registered users; and

the authentication processing part inputs the geometric-transformed intensity image and performs matching between the input image and the handwriting history data stored in the authentication information database, and between the input image and the signature shape data.

25. (Original) The image processing method according to claim 17, further comprising a display part that displays an image produced as a result of performing geometric transformation for the intensity image, based on the range information in the geometric transformation part.

26. (Original) The image processing apparatus claim 17, further comprising:

a storage part that stores range information acquired by the range information acquisition part, wherein a distance between the image holding medium and the image pickup part is fixed, and the geometric transformation part performs geometric transformation for the intensity image based on the range information stored in the storage part.

27. (Currently Amended) An image processing method, comprising:

projecting light to an image holding medium to form an image thereon;

picking up the image projected on the image holding medium;

acquiring an intensity image based on the image picked up in the image pickup step;

acquiring range information from the picked-up image;

performing geometric transformation for the intensity image based on the range information acquired in the range information acquisition step; and

extracting difference between the geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

storing, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step;

making comparison between successive geometric-transformed intensity images in the time-series transformed in the geometric transformation step; and

retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.

28. (Original) The image processing method according to claim 27, wherein the image holding medium is one of a manuscript sheet, whiteboard, blackboard, screen, wall and screen projection sheet.

29. (Original) The image processing method according to claim 27, wherein the intensity image acquired in advance as a processing target in the image extracting step is a preceding frame image inputted precedent to the geometric transformation step.

30. (Original) The image processing method according to claim 27, wherein the intensity image acquired in advance as a processing target in the image extracting step is image data stored in advance in a storage part.

31. (Original) The image processing method according to claim 27, further comprising:

storing plural pieces of document format data in a document database; and

performing matching between a geometric-transformed intensity image and the pieces of document format data stored in the document database,

wherein the image extracting step extracts difference between the geometric-transformed intensity image and the pieces of document format data stored in the document database.

32. (Currently Amended) The image processing method according to claim 27, further comprising:

reading character data extracted in the image extracting step and ~~transforming it to character data replaceable as a code value~~identifies the character data with identification data.

33. (Original) The image processing method according to claim 27, further comprising:

storing handwriting history data of registered users in a authentication information database; and

inputting the geometric-transformed intensity image and performing matching between the input image and the handwriting history data stored in the authentication information database.

34. (Original) The image processing apparatus according to claim 33, further comprising:

in addition to the handwriting history data, storing signature shape data of registered users in the authentication information database; and

inputting the geometric-transformed intensity image and performing matching between the input image and the handwriting history data stored in the authentication information database, and between the input image and the signature shape data.

35. (Original) The image processing method according to claim 27, further comprising:

displaying an image produced as a result of performing geometric transformation for the intensity image based on the range information.

36. (Original) The image processing method according to claim 27, further comprising:

storing range information acquired in the range information acquiring step,

wherein a distance between an image holding medium and the image pickup part is fixed and the geometric transformation for the intensity image is performed based on the range information stored in the storage step.

37. (Currently Amended) A storage medium readable by a computer, the storage medium storing a program of instructions executable by the computer to perform method steps for performing image processing, the method comprising the steps of:

projecting light to an image holding medium to form an image thereon;

picking up the image formed on the image holding medium;

acquiring an intensity image based on the image picked up in the image pickup step;

acquiring range information from the picked-up image;

performing geometric transformation for the intensity image based on the range information acquired in the range information acquisition step;

and

extracting difference between the geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

storing, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step;

making comparison between successive geometric-transformed intensity images in the time-series transformed in the geometric transformation step; and

retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.

38. (Currently Amended) An image processing apparatus, comprising:

a projecting part that projects light;

an image pickup part that picks up the projected light;

an intensity image acquisition part that acquires an intensity image from the picked-up light;

a range information acquisition part that acquires range information from the picked-up light;

a geometric transformation part that performs geometric transformation for the intensity image based on the range information; and

an image extracting part that extracts difference between the geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

a storage part that stores, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed by the geometric transformation part;

the image extracting part making comparison between successive geometric-transformed intensity images in the time-series transformed by the geometric transformation part; and

an image processing part that retrieves only differential data between successive geometric-transformed intensity images in the time series as storage data based on a result of the comparison of the image extracting part of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.

39. An image processing method, comprising:

projecting light;

picking up the projected light;

acquiring an intensity image from the picked-up light;

acquiring range information from the picked-up light;

performing geometric transformation for the intensity image based on the range information; and

extracting difference between the geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

storing, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step;

making comparison between successive geometric-transformed intensity images in the time-series transformed in the geometric transformation step; and

retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed

intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.

40. A storage medium readable by a computer, the storage medium storing a program of instructions executable by the computer to perform method steps for performing image processing, the method comprising the steps of:

projecting light;

picking up the projected light;

acquiring an intensity image from the picked-up light;

acquiring range information from the picked-up light;

performing geometric transformation for the intensity image based on the range information; and

extracting difference between the geometric-transformed intensity image and ~~the~~an intensity image acquired in ~~advance.~~advance;

storing, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step;

making comparison between successive geometric-transformed intensity images in the time-series transformed in the geometric transformation step; and

retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series.